SANDAKANIA 20 (2015): 155–164

Three New *Begonia* (Begoniaceae) Species from Ultramafic Outcrops in Kinabalu Park, Sabah, Malaysia

Rimi Repin[1], Rossiti M. Karim[2] & Handry Mujih[3]

Sabah Parks,
P.O. Box 10626,
88806 Kota Kinabalu,
Sabah, Malaysia.
email:
[1] rimi689@yahoo.com
[2] rossitikarim@yahoo.com
[3] handrymujih@gmail.com

Summary. Three new species, *Begonia adliniana* Rimi, *B. ramlanii* Rimi & Handry and *B. vanderentii* Rossiti, from ultramafic outcrops are described and illustrated. *B. ramlanii* is an ultramafic facultative, *B. adliniana* is an ultramafic preferential, and *B. vanderentii* is an ultramafic obligate. All three species belong to section *Petermannia*.

Ultramafic outcrops are widespread and extensive in Sabah, Malaysia, covering an area of approximately 3500 km^2 (Ent *et al*., 2014). Ultramafic outcrops, also referred to in the early literature as ultrabasic or serpentine rocks and derived soils, are chiefly igneous rocks composed of mafic minerals and are high in magnesium, iron, nickel, chromium and cobalt, that are toxic for most plants. The high content of these mafic minerals makes it so different from other soil substrates and it habours a characteristic flora that includes many endemic species that are able to tolerate to this unique substrate. Some 142 km^2 of ultramafic formations are found around Mount Kinabalu, which is the most prominent site regionally in terms of biodiversity for ultramafic substrates (Collenette, 1964; Beaman, 2005). Mount Kinabalu is well known for both its species richness as well as the exceptionally high level of endemism, with many species restricted to a single locality (Ent *et al*., 2014).

Materials and Methods

Materials for this study were collected during routine or scheduled fieldwork by Sabah Park (SNP herbarium) staff from a series of expeditions held in 2010–2013 as part of the "Plant diversity, soil chemistry and geospatial analysis of ultramafic outcrops on Mount Kinabalu and Mount Tambuyukon, Sabah, Malaysia", a research collaboration between Sabah Parks and the University of Queensland, Australia (Fig. 1). Some species were collected and grown in the nursery until they flowered and herbarium specimens were prepared. Conservation assessments follow standard IUCN procedures (IUCN, 2001).

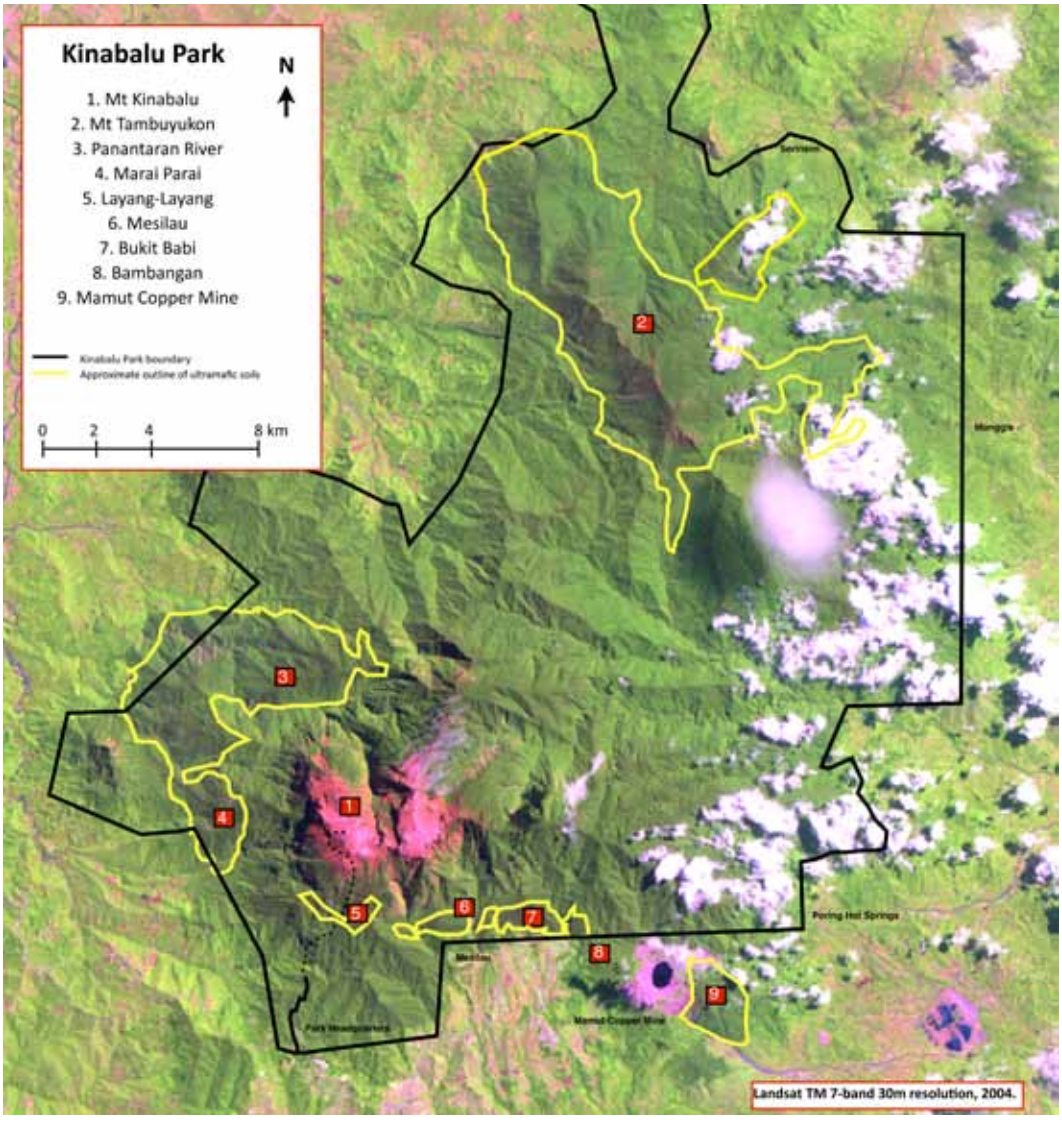

Fig. 1. Study sites on ultramafic outcrops within Kinabalu Park.

Taxonomy Treatment

All of the three new species belong to section *Petermannia*. Following Ent *et al*. (2014), these three species are designated as ultramafic facultatives, if they are sometimes found in ultramafic areas but are more usually found on other substrate types; ultramafic preferentials if they are usually found in ultramafic areas; and ultramafic obligates if they only occur on ultramafic substrates.

Species Descriptions

1. Begonia adliniana Rimi **sp. nov.**

Begonia adliniana is similar to *B. kipandiensis* S. Julia (2015) in its cane-like habit and inflorescences with pale green, dense fringe of long glandular hairs and overlapping bracteoles on the male branches but it differs in its leaf lamina that is only minutely toothed (vs. with prominent teeth 2–5 mm long as in *B. kipandiensis*), its smaller bracteoles *ca*. 4 × 4 mm (vs. 7–8 × 5–8 mm) and its male flowers with 4 tepals (vs. 2 tepals). Type: *Tisun G., Duni M., Benedict G. & Rossiti K. KNP A 15598* Borneo, Sabah, Kota Belud District, Lawag-Kinotoki River, 23 March 2008 (holotype SNP!). (**Fig. 2**)

Cane-like begonia, 40 cm tall. Stems erect, brownish, *ca*. 5 mm diameter, internodes 4.3–5.5 cm long, hairs brownish, succulent, thicker at nodes. Stipules light green, pubescent, elliptic, 6–16 × 5–10 mm, margin toothed, apex bluntly acute, persistent. Leaves alternate, oblique, distant, held horizontally; petiole 2–3.5 cm greenish red, hairs white, 3–4 mm thick, grooved above; lamina plain dark green, in life fleshy, matt, asymmetrical, *ca*. 12–14.5 × 6.5–8.5 cm, broad side 4.8–5.2 cm, broadly ovate, basal lobes 0.6–0.7 cm, margin minutely toothed, apex acute; venation palmate-pinnate, dark green, glabrous, 3 veins on each side of the midrib, unequal, 3 in basal lobe, impressed above and beneath, branching halfway towards margin. Inflorescences protogynous, axillary, white, glabrous, pendent, longer than petioles, 1 female flower on lowest branch, 18 male flowers above in a many-flowered raceme, 6 cm long with 5 branches arranged along the rachis, 3.2 cm long, branches almost equal-sized, 1.8 cm long. Bracts of male and female flowers light green, lanceolate, *ca*. 10 × 5 mm, margin entire with a dense fringe of long glandular hairs, persistent. Bracteoles many, on male branches, overlapping, light green, ovate, *ca*. 4 × 4 mm, margin toothed, persistent. Male flower: pedicel greenish, *ca*. 2 cm long; tepals 4, white, margin entire, outer 2 oval, *ca*. 6–7 × 4–5 mm, apex bluntly acute, inner 2 tepals lanceolate, *ca*. 4–5 × 1 mm, apex acute; stamens 14, cluster rounded, stalk *ca*. 0.5 mm long, light brown; filaments *ca*. 1 mm, white; anthers bright yellow, oval, *ca*. 1 × 0.5 mm, apex rounded. Female flower: pedicel 0.5 mm, light brown, glabrous; ovary white, oblong, *ca*. 6 × 5 mm, locules 3, placentas 2 per locule, ovules many on both surfaces; tepals 4, white, equal-sized, oval, *ca*. 6 × 8 mm, margin entire, apex bluntly acute; styles 3, light yellow, 2 mm long, stigma green, papillose forming a continuous twisted band. Capsule pointing upwards, 1–1.5 × 0.8–1 cm, wings 3, unequal, longer wing 3

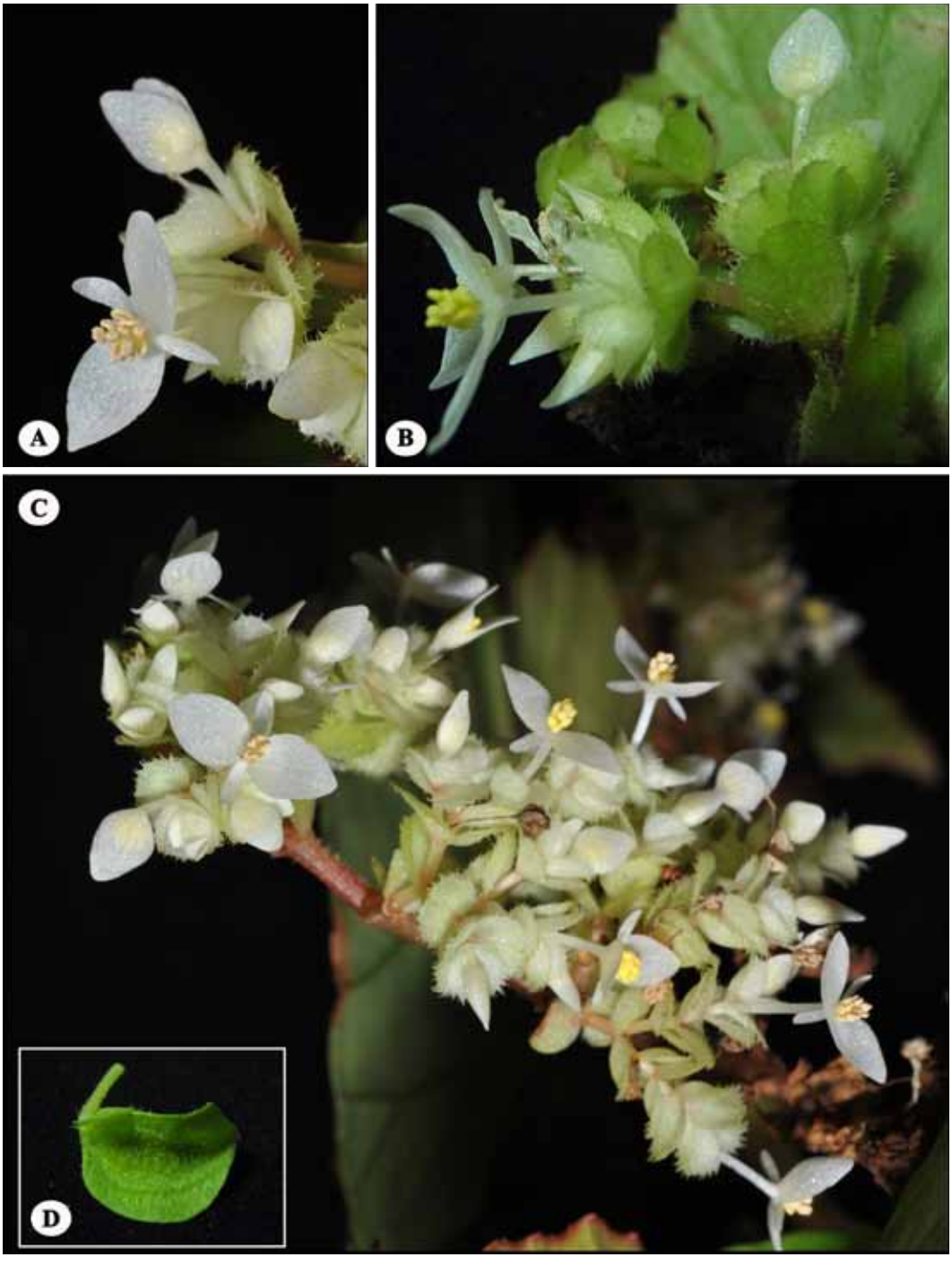

Fig. 2. *Begonia adliniana*. **A.** Male flower; **B.** Bracts on male flower; **C.** Male inflorescence; **D.** Fruit. Photos **A** & **C** by Rimi Repin; Photos **B** & **D** by Rossiti M. Karim.

mm wide, shorter two wings 1.5 mm, wings thinly fibrous, light green, locules 3, placentas 2 per locules, dehiscing between the locule and wing; pedicel reflexed, 5–7 mm long. Seeds barrel-shaped, 0.25 × 0.34 mm, collar cells slightly more than half the seed length.

ETYMOLOGY. Named in honour of YM Dato' Seri Tengku Dr Zainal Adlin bin Tengku Mahmood, the Chairman of The Board of Trustees of Sabah Parks, who has been actively involved in promoting the conservation of flora and fauna in Sabah.

ECOLOGY. Primary forest at 1500 m elevation on ultramafic substrates in shade on slopes. Ultramafic preferential.

DISTRIBUTION. Borneo. Endemic to Sabah (Mt. Kinabalu, near the Kineteki River).

CONSERVATION STATUS. Least Concern. It grows in the Kinabalu Park area, a totally protected area.

SPECIMENS EXAMINED—BORNEO. SABAH: Ranau District: Kinabalu Park — Poring Orchid Centre Nursery, *Rossiti et al. SNP 36818* (SNP!). Cultivated specimen from Poring Orchid Centre Nursery, originally collected from Kineteki, Mt. Kinabalu, Kota Belud District: Lawag-Kinotoki River, *Tisun G., Duni M., Benedict G. & Rossiti K. KNP A 15598* (holotype SNP!).

NOTES. This species is at present growing in the Poring Orchid Centre Nursery from where the type specimen was made. Further specimens for distribution need to be collected as the plants flower and fruit.

2. Begonia ramlanii Rimi & Handry **sp. nov.**

Similar to *Begonia beryllae* Ridl. (1915) in its cane-like habit, ovate leaves with a well-developed basal lobe, undulate margin and red veins, and its male flower with 4 tepals. The differences lie in the fruit of *B. ramlanii*, the width is more than twice the length (1.5 × 3.2 cm) and the wing shape is sharply triangular with a very sharp tip towards the top. The fruit of *B. beryllae* has a width of less than twice the length (1.5–2 × 2–2.5 cm) and the wings are broader with a rounded tip. *Begonia beryllae* has never been recorded as growing on ultramafic substrates. Type: *Handry et al. SNP 36809,* Borneo, Sabah, Ranau, Kinabalu Park, Poring Orchid Centre Nursery, 29 August 2014 (holotype SNP!; isotype SAN!). Cultivated specimen from Poring Orchid Centre Nursery. Originally collected from Nalumad — Sayap Trail, 2011. (**Fig. 3**)

Cane-like begonia, to 40 cm tall. Stems branching, erect, red, to 6 mm diameter, internodes 7.5–10 cm long, with soft red hairs, succulent, thicker at nodes. Stipules reddish green,

lanceolate, *ca*. 10–20 × 2–5 mm, margin entire, apex acute, caducous. Leaves alternate, distant, pendant, pointing downward; petiole red, hairy, 2.3–4.5 cm long, grooved above; lamina plain green, in life fleshy, matt, oblique, asymmetrical, *ca*. 3.5–18 cm × 8.4–13.4 cm, broad side 5.6–10 cm, base broadly ovate, basal lobes 1.2–1.3 cm, margin doubly toothed, apex acuminate *ca*. 1.3 cm; venation palmate-pinnate, veins red on both surfaces, glabrous, 3 on each side of midrib, 1 in basal lobe, impressed above near the junction between the lamina and petiole but impressed beneath. Inflorescences terminal, white, pendent, longer than petioles, cymose, protogynous; male inflorescence *ca*. 3.5 cm long with 2 branches each 1 cm long, 2 male flowers above; female inflorescence 5.6 cm long, with 2 branches 5.6 cm long and 2 female flowers. Bracts of male and female flowers lacking. Bracteoles of male flowers broadly oval, *ca*. 10 × 10 mm, pale green and margin entire. Bracteoles of female flower *ca*. 3 × 0.5 mm, pale green, needle-shaped, margin entire. Male flower: pedicel pinkish white, 5 mm long; tepals 4, white, glabrous, margin entire, apex rounded, outer 2 tepals oval, *ca*. 10 × 6 mm, inner 2 tepals narrowly lanceolate, 6 × 3 mm; stamens 16, stalk 0.6 mm long, cluster oval; filaments dirty yellow, 0.8 mm long; anthers dirty yellow, oblong, *ca*. 1.5 × 1 mm, apex emarginate. Female flower: pedicel 2 cm long, pinkish green, glabrous; ovary light green, deltoid, *ca*. 1 × 2.5 cm, wings 3, 1 cm wide, unequal, 3 locules, 2 placentas per locule; tepals 5, white, lanceolate, outer three *ca*. 13–14 × 6–7 mm, inner two *ca*. 10 × 3 mm, margin entire, apex rounded; styles 3, bright yellow, 2 mm long, divided to base, stigma yellow, papillose. Capsule dangling, *ca*. 1.5 × 3.2 cm, glabrous, locules 3, wings unequal, deltoid, 1.2 cm wide, fleshy, dehiscing between locule and wing. Seeds barrel-shaped, *ca*. 0.5 × 0.2 mm, columnar cells more than half the seed length.

ETYMOLOGY. Named after Ramlan Miadin, research assistant in Sabah Parks, who collected plant material during exploration of the Nalumad-Sayap ultramafic flora in 2011.

ECOLOGY. Lower montane forest, 1500–2000 m elevation. Ultramafic facultative.

DISTRIBUTION. Borneo. Endemic to Sabah (Kinabalu Park, Nalumad trail from Ranau to Sayap village).

CONSERVATION STATUS. Least Concern. It grows in the Kinabalu Park, a totally protected area.

SPECIMENS EXAMINED—BORNEO. SABAH: Ranau District: Kinabalu Park — *Handry M., Rossiti K. & Kinahim S. SNP 32960* (SNP, SAN), Poring Orchid Centre Nursery, *Handry et al. SNP 36809* (holotype SNP!; isotype SAN!). Cultivated specimen from Poring Orchid Centre Nursery. Originally collected from Nalumad — Sayap (Trail, 2011).

NOTES. This species is striking for having bracteoles that are needle-shaped in female flowers and broadly oval in the male flowers. This species is so far known only from the type collection.

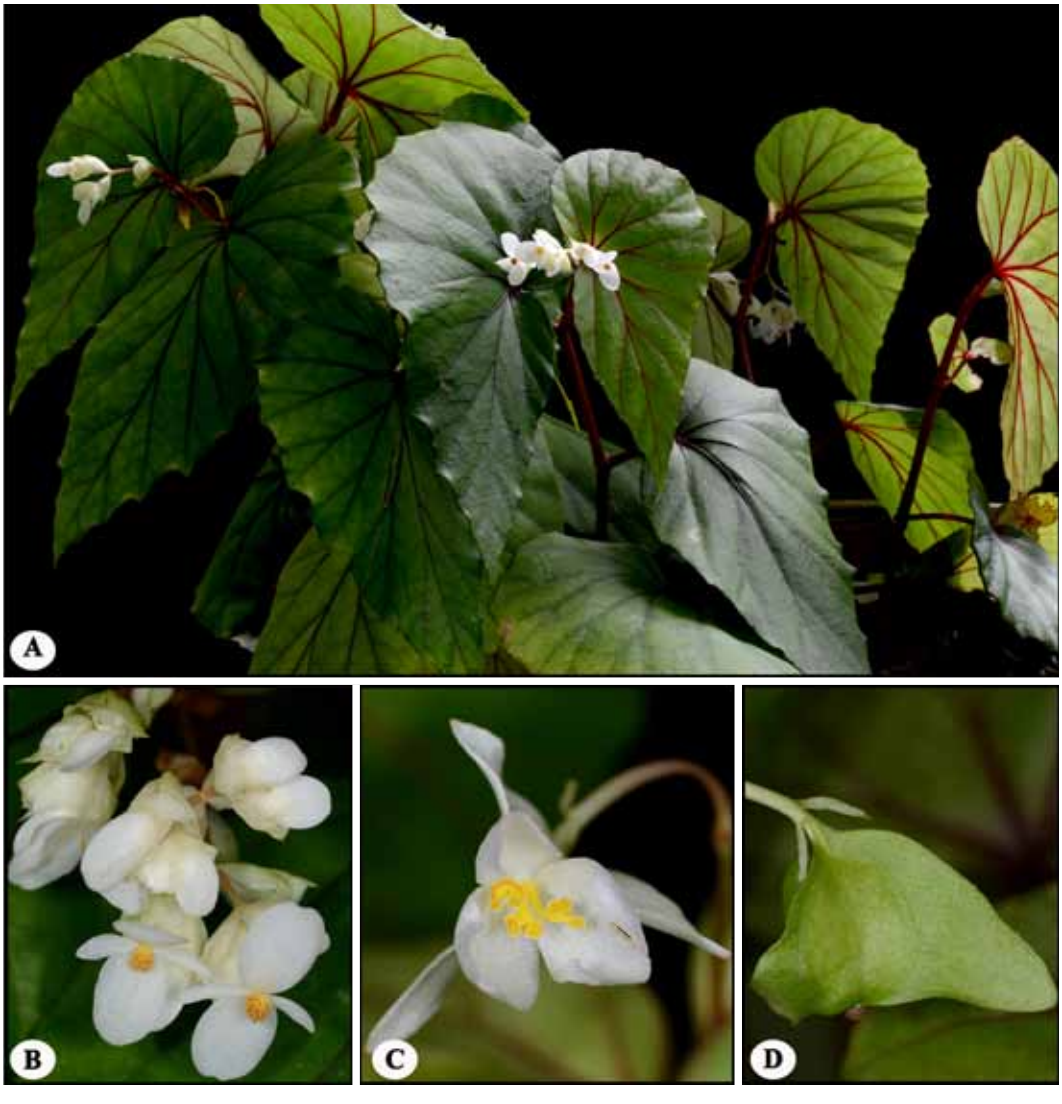

Fig. 3. *Begonia ramlanii*. **A.** Habit; **B.** Inflorescence and male flower; **C.** Female flower; **D.** Fruit. All photos by Ramlan Miadin.

3. Begonia vanderentii Rossiti **sp. nov.**

It resembles *Begonia taniana* V.S. Guanih (2015) in its cane-like habit, glabrous, glossy, dark green leaves with an entire margin and in its pink flowers, but it is different in its extremely attenuated ovate-lanceolate leaves with an acumen to 15 cm long (not 2.5 cm as in *B. taniana*), male flowers with 4 tepals (not 2 tepals), and female tepals with an entire margin (not toothed female tepals). Type: *Antony van der Ent et al. SNP 20947,* Borneo, Sabah,

Ranau District, Kinabalu Park, Monggis sub-station, Mt. Tambuyukon trail, Wuluh Camp to Musang Camp, Plot 1, 13 March 2011 (holotype SNP!). (**Fig. 4**)

Cane-like begonia to 40 cm tall. Stems erect, brown, 5–7 mm thick, becoming woody, internodes 3.5–7.5 cm long, glabrous, branched, swollen at nodes. Stipules pale green, glabrous, slightly triangular, *ca*. 10 × 16 mm, margin entire, apex acute, persistent. Leaves alternate, oblique, distant, *ca*. 7–10 cm apart, pointing downwards; petiole brown, sparsely hairy on the upper part, 3.5–4.5 cm, terete; lamina plain light green on both surfaces, in life fleshy, papery when dry, glossy, oblique, asymmetric, *ca*. 20–22 × 6.5–8.5 cm, broad side 4.5–5.5 cm wide, ovate-lanceolate, basal lobes 3–5.5 cm, margin entire, apex acuminate, acumen to 1–1.5 cm; venation palmate-pinnate, veins light green, 5–6 pairs vein, obscure above, prominent beneath. Inflorescences protogynous, pink, many-flowered raceme, terminal and axillary, glabrous, erect, shorter than petioles, peduncle 2 cm. Bracts on male and female flowers light green, oval, *ca*. 8 × 10 mm, margin entire, persistent. Bracteoles absent. Male flower: pedicel maroon, 5–10 mm long, tepals 4, oval, pinkish, glabrous, margin entire, outer 2, *ca*. 15 × 13 mm, apex rounded; inner 2 tepals oval, *ca*. 9 × 4 mm, apex lanceolate; stamens 20, cluster globose, sessile; filaments yellow, *ca*. 2.5 mm long; anthers yellow, narrowly obovate, *ca*. 1 × 0.2 mm, apex emarginate. Female flower: pedicel 1–1.5 cm, maroon, glabrous; ovary, pinkish-green, *ca*. 9 × 6 mm, locules 3, placentas 2 per locule, tepals 5, broadly oval, pink, outermost 4, equal, *ca*. 14 × 8 mm, innermost tepal smaller *ca*. 10 × 4 mm, margin entire, apex rounded; styles 3, yellow, 3 mm long, Y-shaped, divided to base; stigma yellow, papillose forming a continuous twisted band. Capsule 1.5 × 2.4 cm, glabrous, wings 3, equal, 18 × 10 mm, thinly fibrous, dehiscing between locule and wing; pedicel stiff, 2–3 cm long, maroon. Seeds barrel-shaped, *ca*. 0.5 × 0.2 mm, collar cells slightly more than half the seed length.

ETYMOLOGY. Named in honour of Dr Antony van der Ent, University of Queensland, Australia, research collaborator of Sabah Parks in the *Plant diversity, soil chemistry and geospatial analysis of ultramafic outcrops on Mount Kinabalu and Mount Tambuyukon Sabah, Malaysia 2009–2013* project. This project was led to the discovery of many new plant species including this begonia as well as the production of the landmark book on *The Ultramafic Flora of Sabah* (Ent *et al*., 2014).

ECOLOGY. Growing in ultramafic areas at 300–1200 m elevation. Ultramafic obligate.

DISTRIBUTION. Borneo. Endemic to Sabah (Kinabalu Park, Mt. Tambuyukon, Serinsim substation and Monggis substation (Musang Camp, Wuluh Camp)).

CONSERVATION STATUS. Least Concern. It grows in the Kinabalu Park area, a totally protected area.

SPECIMENS EXAMINED—BORNEO. SABAH: Ranau and Kota Marudu District: Kinabalu Park — Serinsim substation, *Masrina et al. SP 10534* (SNP); Mt. Tambuyukon-Musang Camp Plot 2, *Antony van der Ent et al. SNP 21258* (SNP), Mt. Tambuyukon-

Fig. 4. *Begonia vanderentii*. **A.** Habit; **B.** Female flower; **C.** Male flower; **D.** Fruit. All photos by Rossiti M. Karim.

Wuluh Monggis Plot 5, *Antony van der Ent et al. SNP 31770* (SNP), *SNP 31953* (SNP), Mt. Tambuyukon-Wuluh Camp Plot 7, *Antony van der Ent et al. SNP 31857* (SNP), *SNP 37299* (SNP), Mt. Tambuyukon-Musang Camp (Tambuyukon Expedition 2007), *Yabainus et al. SP 12012* (SNP); Monggis sub-station, Mt. Tambuyukon trail, Wuluh Camp to Musang Camp, Plot 1, *Antony van der Ent et al. SNP 20947* (holotype SNP!).

NOTES. This species was illustrated by Ent *et al.* (2014) as *Begonia* sp. nov. 2 on page 91. It is restricted to ultramafic soil. The leaves of the juvenile plants are wavy.

ACKNOWLEDGEMENTS

We gratefully acknowledge the management of Sabah Parks particularly the Director of Sabah Parks for his support of biodiversity research work on *Begonia* in the Sabah Parks area. We are sincerely grateful to Dr Ruth Kiew (FRIM) and Julia Sang (Sarawak Forestry) who shared their detailed knowledge on begonias, and for their suggestions and comments in improving this paper. We would also like to thank all our fellow colleagues, Matsain M. Buang, Justinus G., Geofarry G., Dolois S., Kinahim S. and Yabainus J., for their assistance during the field work and in the herbarium. We also want to thank the management of Sabah Forestry Department and the Curator of SAN Herbarium for their support in facilitating our research by permitting us to access the herbarium specimens in their care.

REFERENCES

Beaman, J.H. (2005). Mount Kinabalu: Hotspot of Plant Diversity in Borneo. *Biol. Skr.* 55: 103–127.

Chong, F.Y., Guanih, V.S., Julia, S. & Kiew, R. (2015). *Begonia* (Begoniaceae) in the Danum Valley Conservation Area, Sabah, Borneo, including Eleven New Species. *Sandakania* 30: 51–85.

Collenette, P. (1964). A short account of the geology and geological history of Mt. Kinabalu. *Proceedings of the Royal Society of London. Series B, Biological Sciences* 161: 56–63.

Ent, van der A., Repin, R., Sugau, J.B. & Wong, K.M. (2014). *The Ultramafic Flora of Sabah: An Introduction to the Plant Diversity on Ultramafic Soils*. 241 p.

IUCN (2001). *IUCN Red List Category and Criteria. Version 3.1*. IUCN Species Survival Commission. Gland, Switzerland and Cambridge, U.K.

Ridley, H.N. (1915). *Begonia beryllae* Ridl. *Sarawak Museum Journal* 2: 177.

Rimi, R., Julia, S., Kiew, R. & Handry, M. (2015). Eleven New Species of *Begonia* (Begoniaceae) from the Crocker Range, Sabah, Malaysia. *Phytotaxa* (in press).